

CLAIMS

WHAT IS CLAIMED IS:

1. A method for providing communications data, in a satellite communications network, between user terminals and a ground station via a satellite, comprising:

generating at least one carrier signal in a spot beam covering user terminals, said carrier signal conveying communications data over at least one downlink to the user terminals; and

modulating a single carrier signal simultaneously with first and second independent communications data streams over first and second modulation channels, respectively, of a multi-dimensional modulator.

2. The method of claim 1, further comprising:

assigning said first communications data stream to a first terminal located near an edge of the beam spot; and

assigning said second communications data stream to a second terminal located near a center of the beam spot.

3. The method of claim 1, further comprising:

assigning said first and second communications data streams to first and second terminals, respectively, based on a signal strength of downlinks to said terminals.

4. The method of claim 1, further comprising:

before modulation, encoding said first and second communications data streams based upon different encoder rates.

5. The method of claim 1, further comprising:

modulating simultaneously the first and second communications data streams over the I and Q channels, respectively, of a QPSK modulator.

6. A method for providing communications data, in a satellite communications network, between user terminals and a ground station via a satellite, comprising:

generating at least one carrier signal in a spot beam covering user terminals, said carrier signal conveying communications data over at least one downlink to the user terminals; and

modulating a single carrier signal simultaneously with first and second independent communications data streams over first and second modulation channels, respectively, of a multi-dimensional modulator comprising:

modulating the first communications data stream over first and second modulation channels of a QAM modulator; and

simultaneously modulating the second communications data stream over a third modulator channel of the QAM modulator.

7. The method of claim 1, further comprising:

simultaneously establishing first and second communications links with first and second user terminals, respectively, through said first and second modulation channels.

8. The method of claim 1, further comprising:

limiting an entire communications link with a first terminal to one channel of said multi-dimensional modulator.

9. A method for providing communications data, in a satellite communications network, between user terminals and a ground station via a satellite, comprising:

generating at least one carrier signal in a spot beam covering user terminals, said carrier signal conveying communications data over at least one downlink to the user terminals; and

modulating a single carrier signal simultaneously with first and second independent communications data streams over first and second modulation channels, respectively, of a multi-dimensional modulator; and

limiting an entire communications link with a first terminal to one channel of said multi-dimensional modulator; and

limiting an entire communications link with a first terminal to one channel of said multi-dimensional modulator.

10. The method of claim 1, further comprising:

attempting to establish a communications link between the satellite and a user terminal over the first modulation channel of the multi-dimensional modulator;

determining that the first modulation channel is not carrying data directed to the user terminal; and

switching to another modulation channel of the multi-dimensional modulator, after the determining step and again attempting to establish a communications link.

11. A satellite system comprising:

multiple terminals;

a satellite generating a beam, said beam defining a coverage area of said beam, said satellite using a common carrier signal to transmit data to multiple terminals located in said beam; and

a ground station including a multi-dimensional modulator having at least two input channels receiving first and second separate data streams associated with

independent communications links with first and second terminals, respectively, the modulator assigning the first and second data streams to first and second dimensions, respectively, of a multi-dimensional modulator.

12. A satellite system comprising:

multiple terminals;

a satellite generating a beam, said beam defining a coverage area of said beam, said satellite using a common carrier signal to transmit data to multiple terminals located in said beam; and

a ground station including a multi-dimensional modulator having at least two input channels receiving first and second separate data streams associated with independent communications links with first and second terminals, respectively, the modulator assigning the first and second data streams to first and second dimensions, respectively, of a multi-dimensional modulator;

said modulator assigning said first communications data stream to a first terminal located near an edge of said coverage area of said beam; and

said modulator assigning said second communications data stream to a second terminal located near a center of the coverage area of the beam.

13. The system of claim 11, wherein said modulator assigns said first and second communications data streams to first and second terminals, respectively, based on the signal strength of downlinks from the satellite to said terminals.

14. A satellite system comprising:

multiple terminals;

a satellite generating a beam, said beam defining a coverage area of said beam, said satellite using a common carrier signal to transmit data to multiple terminals located in said beam;

a ground station including a multi-dimensional modulator having at least two input channels receiving first and second separate data streams associated with independent communications links with first and second terminals, respectively, the modulator assigning the first and second data streams to first and second dimensions, respectively, of a multi-dimensional modulator; and

an encoder for encoding said first and second communications data streams based on different encoding rates and providing first and second encoded communications data streams to first and second input channels of said modulator, respectively.

15. A satellite system comprising:

multiple terminals;

a satellite generating a beam, said beam defining a coverage area of said beam, said satellite using a common carrier signal to transmit data to multiple terminals located in said beam; and

a ground station including a multi-dimensional modulator having at least two input channels receiving first and second separate data streams associated with independent communications links with first and second terminals, respectively, the modulator assigning the first and second data streams to first and second dimensions, respectively, of a multi-dimensional modulator,

said modulator simultaneously modulating said first and second communications data streams over I and Q modulation channels, respectively, of a QPSK modulator.

16. The system of claim 11, further comprising:

a QAM modulator having first and second modulation channels receiving said first communications data stream and having a third modulation channel receiving said second communications data stream, said QAM modulator simultaneously modulating said first and second

communications data streams over corresponding modulation channels.

17. The system of claim 11, further comprising:

first and second user terminals simultaneously establishing first and second communications links, respectively, with said ground station through said first and second modulation channels.

18. The system of claim 11, wherein said modulator limits an entire communications link with a first terminal to one channel of said multi-dimensional modulator.

19. The system of claim 11, wherein said modulator limits an entire communications link with a first terminal to fewer than all channels of said multi-dimensional modulator.

20. A satellite system comprising:

multiple terminals;

a satellite generating a beam, said beam defining a coverage area of said beam, said satellite using a common carrier signal to transmit data to multiple terminals located in said beam; and

a ground station including a multi-dimensional modulator having at least two input channels receiving first and second separate data streams associated with independent communications links with first and second terminals, respectively, the modulator assigning the first and second data streams to first and second dimensions, respectively, of a multi-dimensional modulator;

at least one of said multiple terminals comprising:

a processor, at a terminal, attempting to establish a communications link between said terminal and satellite over a first modulation channel defined by the multi-dimensional modulator, said processor determining that the first modulation channel is not carrying data directed to said terminal; and

a switch controlled by the processor to switch to another modulation channel after determining that the first modulation channel was incorrect.

21. A communication data signal embodied in a carrier wave of a downlink from a communications satellite, comprising:

first and second independent communications data streams modulated, simultaneously and in parallel, onto respective first and second modulation channels defined in accordance with a multi-dimensional modulation

technique, said first and second communications data streams carrying independent and unrelated data.

22. The communications data stream of claim 21, further comprising encoded communications data in at least one of said first and second communications data streams.

23. The communications data signal of claim 21, wherein said first and second independent communications data streams are modulated onto the I and Q channels, respectively, of a QPSK modulation technique.

24. The communications data signal of claim 21, further comprising:

first, second and third independent communications data streams directed to first, second and third user terminals, modulated onto first, second and third modulation channels of a 16-QAM modulation technique.